

Claims

- [c1] 1. A two-layer composite material for use in translucent, flame-resistant components, the composite material comprising:
 - a polyphenylsulfone substrate material; and
 - a plurality of long glass fibers substantially embedded within said polyphenylsulfone substrate material such that the composite material has an average allowable heat release not to exceed a 65/65 standard.
- [c2] 2. The two-layer composite material of claim 1, wherein said plurality of long glass fibers is selected from the group consisting of a plurality of unidirectional long glass fibers and a plurality of long e-type glass fibers.
- [c3] 3. The two-layer composite material of claim 1, wherein said plurality of long glass fibers comprises a plurality of long s-type glass fibers.
- [c4] 4. The two-layer composite material of claim 1, wherein said translucent, flame-resistant components comprises an interior component contained within a commercial aircraft.

[c5] 5.The two-layer composite material of claim 4, wherein said interior component is selected from the group consisting of a countertop, a cabinet enclosure, a tray table, a backlit lighted sign, an illuminating window panel, a window bezel, a class divider, a privacy partition, a backlit ceiling panel, a direct lighting ceiling panel, a backlit control panel, a lighted door, a lighted door latch, a doorway lining, a proximity light, a stow bin door, a privacy curtain, a translucent door handle, a translucent amenities cabinet, a translucent sink deck a doorway liner, a stow bin latch handle, and a lighted phone.

[c6] 6.The two-layer composite material of claim 1, wherein said plurality of long glass fibers comprises a weaved glass cloth material having a plurality of long glass fibers.

[c7] 7.The two-layer composite material of claim 6, wherein said plurality of long glass fibers is selected from the group consisting of a plurality of long e-type glass fibers and a plurality of long s-type glass fibers.

[c8] 8.A three-layer composite material for use in translucent, flame-resistant components, the composite material comprising:
a first layer of a polyphenylsulfone substrate material;
a second layer of said polyphenylsulfone substrate mate-

rial; and

a plurality of long glass fibers sandwiched between and substantially embedded within said first layer and said second layer such that the composite material has an average allowable heat release not to exceed a 65/65 standard.

- [c9] 9. The three-layer composite material of claim 8, wherein said plurality of long glass fibers comprises a plurality of unidirectional long glass fibers.
- [c10] 10. The three-layer composite material of claim 8, wherein said plurality of long glass fibers comprises a plurality of long e-type glass fibers.
- [c11] 11. The three-layer composite material of claim 8, wherein said plurality of long glass fibers comprises a plurality of long s-type glass fibers.
- [c12] 12. The three-layer composite material of claim 8, wherein said translucent, flame-resistant components comprises an interior component contained within a commercial aircraft.
- [c13] 13. The three-layer composite material of claim 12, wherein said interior component is selected from the group consisting of a countertop, a cabinet enclosure, a tray table, a backlit lighted sign, an illuminating window

panel, a window bezel, a class divider, a privacy partition, a backlit ceiling panel, a direct lighting ceiling panel, a backlit control panel, a lighted door, a lighted door latch, a doorway lining, a proximity light, a stow bin door, a privacy curtain, a translucent door handle, a translucent amenities cabinet, a translucent sink deck a doorway liner, a stow bin latch handle, and a lighted phone.

[c14] 14. The three-layer composite material of claim 8, wherein said plurality of long glass fibers comprises a weaved glass cloth material having a plurality of long glass fibers.

[c15] 15. The two-layer composite material of claim 14, wherein said plurality of long glass fibers is selected from the group consisting of a plurality of long e-type glass fibers and a plurality of long s-type glass fibers.

[c16] 16. A three-layer composite material for use in translucent, flame-resistant components, the composite material comprising:
a first layer of a plurality of long glass fibers
a second layer of a plurality of long glass fibers; and
a layer of polyphenylsulfone substrate material sandwiched between and embedding said first layer and said second layer such that the composite material has an av-

erage allowable heat release not to exceed a 65/65 standard.

- [c17] 17. The two-layer composite material of claim 16, wherein said plurality of long glass fibers is selected from the group consisting of a plurality of unidirectional long glass fibers and a plurality of long e-type glass fibers.
- [c18] 18. The two-layer composite material of claim 16, wherein said plurality of long glass fibers comprises a weaved glass cloth material having a plurality of long glass fibers.
- [c19] 19. A method for forming a composite material for use in translucent, flame-resistant components, the method comprising:
 - introducing a layer of polyphenylsulfone substrate material to a mold;
 - introducing a fibrous material onto an entire top surface of said polyphenylsulfone substrate material within said mold, said fibrous material comprising a plurality of long glass fibers;
 - preheating said mold to a first temperature to soften said polyphenylsulfone substrate material;
 - laminating said fibrous material to said polyphenylsulfone substrate material such that said plurality of long

glass fibers are substantially encapsulated within said polyphenylsulfone substrate material while substantially preventing said polyphenylsulfone substrate from out-gassing;

cooling said mold under controlled heat and pressure to form the composite material; and
removing said composite material from said mold.

- [c20] 20. The method of claim 19, wherein introducing a fibrous material comprises introducing a plurality of uni-directional long glass fibers onto an entire top surface of said polyphenylsulfone substrate material within said mold.
- [c21] 21. The method of claim 19, wherein introducing a fibrous material comprises introducing a weaved glass fiber layer onto an entire top surface of said polyphenylsulfone substrate material within said mold, said weaved glass fiber layer comprising a plurality of long glass fibers.
- [c22] 22. The method of claim 19, wherein preheating said mold comprises preheating said mold to about 535 degrees Fahrenheit over about 15 minutes to soften said polyphenylsulfone substrate material.
- [c23] 23. The method of claim 22, wherein laminating said fi-

brous material to said polyphenylsulfone substrate material comprises:

holding said mold at about 535 degrees Fahrenheit for 0 minutes to about 55 minutes;

increasing said pressure of said mold at 0 minutes to about 15 pounds per square inch part pressure;

holding said mold at about 15 pounds per square inch part pressure between about 0 minutes and about 5 minutes;

increasing said pressure from about 15 pounds per square inch part pressure to about 50 pounds per square inch part pressure at 5 minutes;

holding said mold at about 50 pounds per square inch part pressure between about 5 minutes and about 27 minutes;

increasing said pressure from about 50 pounds per square inch part pressure to about 100 pounds per square inch part pressure at 27 minutes;

holding said mold at about 100 pounds per square inch part pressure between about 27 minutes and about 47 minutes;

increasing said pressure from about 100 pounds per square inch part pressure to about 200 pounds per square inch part pressure at 47 minutes; and

holding said mold at about 200 pounds per square inch part pressure between about 47 minutes and about 55

minutes.

- [c24] 24. The method of claim 23, wherein cooling said mold comprises:
 - slowly cooling said mold from about 535 degrees Fahrenheit to about 235 degrees Fahrenheit at 200 pounds per square inch part pressure at a cooling rate of about 5 degrees Fahrenheit per minute; and
 - further cooling said mold to about 150 degrees Fahrenheit at about 100 pounds per square inch part pressure.
- [c25] 25. A method for forming a composite material for use in translucent, flame-resistant components, the method comprising:
 - introducing a polyphenylsulfone substrate material to an extruder;
 - melting said polyphenylsulfone substrate material within said extruder;
 - introducing a first portion of said melted polyphenylsulfone substrate material to a calendar stack;
 - introducing a fibrous material layer onto a top surface of said first portion within said calendar stack, said fibrous substrate material layer comprising a plurality of long glass fibers;
 - pressing said fibrous substrate material layer within said melted polyphenylsulfone substrate material within said calendar stack to form the composite material such that

said plurality of long glass fibers are substantially encapsulated within said melted polyphenylsulfone substrate material; and

removing the composite material from the calendar stack.

[c26] 26. The method of claim 25, wherein introducing a fibrous material layer comprises introducing a layer of unidirectional long glass fibers onto an entire top surface of said melted polyphenylsulfone substrate material within said calendar stack.

[c27] 27. The method of claim 25, wherein introducing a fibrous material layer comprises introducing a weaved glass fiber layer onto an entire top surface of said melted polyphenylsulfone substrate material within said calendar stack, said weaved glass fiber layer comprising a plurality of long glass fibers.

[c28] 28. A method for forming a composite material for use in translucent, flame-resistant components, the method comprising:

introducing a first layer of a polyphenylsulfone substrate material to a mold;

introducing a fibrous material onto an entire top surface of said polyphenylsulfone substrate material within said mold, said fibrous material comprising a plurality of long

glass fibers;
introducing a second layer of said polyphenylsulfone substrate material to a mold such that said fibrous material is sandwiched between said first layer and said second layer;
preheating said mold to a first temperature to soften said first layer and said second layer;
laminating said fibrous material to said first layer and said second layer such that said plurality of long glass fibers are substantially encapsulated within said polyphenylsulfone substrate material while substantially preventing said first layer and said second layer from outgassing;
cooling said mold under controlled heat and pressure to form the composite material; and
removing said composite material from said mold.

[c29] 29. The method of claim 28, wherein introducing a fibrous material comprises introducing a plurality of uni-directional long glass fibers onto an entire top surface of said polyphenylsulfone substrate material within said mold.

[c30] 30. The method of claim 28, wherein introducing a fibrous material comprises introducing a weaved glass fiber layer onto an entire top surface of said polyphenylsulfone substrate material within said mold, said weaved

glass fiber layer comprising a plurality of long glass fibers.

- [c31] 31. The method of claim 28, wherein preheating said mold comprises preheating said mold to about 535 degrees Fahrenheit over about 15 minutes to soften said polyphenylsulfone substrate material.
- [c32] 32. The method of claim 31, wherein laminating said fibrous material to said polyphenylsulfone substrate material comprises:
 - holding said mold at about 535 degrees Fahrenheit for 0 minutes to about 55 minutes;
 - increasing said pressure of said mold at 0 minutes to about 15 pounds per square inch part pressure;
 - holding said mold at about 15 pounds per square inch part pressure between about 0 minutes and about 5 minutes;
 - increasing said pressure from about 15 pounds per square inch part pressure to about 50 pounds per square inch part pressure at 5 minutes;
 - holding said mold at about 50 pounds per square inch part pressure between about 5 minutes and about 27 minutes;
 - increasing said pressure from about 50 pounds per square inch part pressure to about 100 pounds per square inch part pressure at 27 minutes;

holding said mold at about 100 pounds per square inch part pressure between about 27 minutes and about 47 minutes;

increasing said pressure from about 100 pounds per square inch part pressure to about 200 pounds per square inch part pressure at 47 minutes; and holding said mold at about 200 pounds per square inch part pressure between about 47 minutes and about 55 minutes.

[c33] 33. The method of claim 32, wherein cooling said mold comprises:

slowly cooling said mold from about 535 degrees Fahrenheit to about 235 degrees Fahrenheit at 200 pounds per square inch part pressure at a cooling rate of about 5 degrees Fahrenheit per minute; and further cooling said mold to about 150 degrees Fahrenheit at about 100 pounds per square inch part pressure.

[c34] 34. A method for forming a translucent, flame resistant component for use in the cabin area of a commercial aircraft, the method comprising:

forming a composite material, said composite material comprising a polyphenylsulfone substrate material substantially encapsulating a plurality of long glass fibers, wherein said composite material has an average allowable heat release not to exceed a 65/65 standard; and

post processing said composite material to form the translucent, flame resistant component.

- [c35] 35. The method of claim 34, wherein said translucent, flame resistant component is selected from the group consisting of a countertop, a cabinet enclosure, a tray table, a backlit lighted sign, an illuminating window panel, a window bezel, a class divider, a privacy partition, a backlit ceiling panel, a direct lighting ceiling panel, a backlit control panel, a lighted door, a lighted door latch, a doorway lining, a proximity light, a stow bin door, a privacy curtain, a translucent door handle, a translucent amenities cabinet, a translucent sink deck a doorway liner, a stow bin latch handle, and a lighted phone.
- [c36] 36. The method of claim 34, wherein forming a composite material comprises:
 - introducing a layer of polyphenylsulfone substrate material to a mold;
 - introducing a fibrous material onto an entire top surface of said polyphenylsulfone substrate material within said mold, said fibrous material comprising a plurality of long glass fibers;
 - preheating said mold to a first temperature to soften said polyphenylsulfone substrate material;
 - laminating said fibrous material to said polyphenylsulfone substrate material.

fone substrate material such that said plurality of long glass fibers are substantially encapsulated within said polyphenylsulfone substrate material while substantially preventing said polyphenylsulfone substrate from out-gassing;

cooling said mold under controlled heat and pressure to form the composite material; and

removing said composite material from said mold.

[c37] 37. The method of claim 34, wherein forming a composite material comprises:

introducing a first layer of a polyphenylsulfone substrate material to a mold;

introducing a fibrous material onto an entire top surface of said polyphenylsulfone substrate material within said mold, said fibrous material comprising a plurality of long glass fibers;

introducing a second layer of said polyphenylsulfone substrate material to a mold such that said fibrous material is sandwiched between said first layer and said second layer;

preheating said mold to a first temperature to soften said first layer and said second layer;

laminating said fibrous material to said first layer and said second layer such that said plurality of long glass fibers are substantially encapsulated within said

polyphenylsulfone substrate material while substantially preventing said first layer and said second layer from outgassing;

cooling said mold under controlled heat and pressure to form the composite material; and
removing said composite material from said mold.

[c38] 38. The method of claim 34, wherein forming a composite material comprises:

introducing a polyphenylsulfone substrate material to an extruder;
melting said polyphenylsulfone substrate material within said extruder;

introducing a first portion of said melted polyphenylsulfone substrate material to a calendar stack;

introducing a fibrous material layer onto a top surface of said first portion within said calendar stack, said fibrous substrate material layer comprising a plurality of long glass fibers;

pressing said fibrous substrate material layer within said melted polyphenylsulfone substrate material within said calendar stack to form the composite material such that said plurality of long glass fibers are substantially encapsulated within said melted polyphenylsulfone substrate material; and

removing the composite material from the calendar

stack.

[c39] 39. The method of claim 34, wherein post processing said composite material is selected from the group consisting of cutting said composite material to a desired shape and size, thermoforming said composite material to a desired shape and size and bonding said composite material to a desired shape and size.